

A REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS ANISACANTHUS¹

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INTRODUCTION

Anisacanthus is a small genus of the Acanthaceae, which, because of the relatively few collections and the obscure specific characters, has been poorly understood. The present study was undertaken to correlate the morphological characters of the taxonomic entities of the genus as a whole, and to determine the relative value of the different characters in specific and varietal delimitation.

Anisacanthus is one of several genera segregated from *Justicia*, having been described by Nees² in the year 1842. He based it on *Justicia quadrifida* Vahl,³ which in turn was founded on *J. coccinea* Cavanilles,⁴ a plant grown in the gardens of Madrid from stock brought from Mexico probably in the latter part of the eighteenth century. Vahl had changed the species name from *coccinea* to *quadrifida* because of the earlier *J. coccinea* Aublet. Under the name *Justicia quadrifida* Vahl, it was not infrequently cultivated in European gardens; and fortunately several authentic specimens from horticulture have been preserved in herbaria. Nees, however, soon changed the name of the type species to *Anisacanthus virgularis* (Salisbury) Nees,⁵ and as such it was known until Standley revived the specific name *quadrifidus*.⁶

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² Nees ab Esenbeck, C. G. *Linnaea* **16**: 307. 1842.

³ Vahl, M. *Enum. Pl.* **1**: 124. 1805.

⁴ Cavanilles, A. J. *Icon. et Descr. Pl.* **2**: 77, *pl.* 199. 1793.

⁵ Nees in DC. *Prodr.* **11**: 445. 1847.

⁶ Standley, P. C., *Contr. U. S. Nat. Herb.* **23**: 1343. 1926.

Three of the species of *Anisacanthus* have been segregated from other genera. Nees transferred *A. pumilus* from *Justicia*, and Gray removed *A. Wrightii* and *A. Thurberi* from *Drejera*. *A. insignis*, *A. abditus*, *A. Gonzalezii*, and *A. tulensis* have been described from collections of later explorations.

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GENERAL MORPHOLOGY

Stems.—The genus *Anisacanthus* consists of suffruticose plants, varying from erect to prostrate in habit, and mostly less than a meter in height or length. The wood is tan or brown in color, evenly grained, soft and brittle to relatively hard. The bark of the upper branches is thin, fibrous, rather brittle, exfoliating in longitudinal strips; on the lower branches it is gray, and relatively fine-grained. Stem pubescence is mostly confined to two opposite longitudinal strips continuous with the base of the petioles. The stem is terete, usually minutely fluted or striate.

Leaves.—The leaves vary considerably on a single plant, but within fairly consistent ranges throughout the group. The mature leaves are usually lanceolate-acuminate with acute or obtuse bases, but sometimes with broader and cordate bases. In one species, *A. insignis*, the linear and sessile leaf-characters serve as a basis for segregating the variety *linearis*. Dietrich, in describing *Justicia pumila*, mentioned the fact that the base of the leaf-blade was somewhat oblique. This character is not confined to that one species, however, but is infrequently found in others. Cystoliths are usually noticeable on the upper surface, especially if the leaf is glabrous. Punctate

glands on the lower surface are also characteristic of the group. Pubescence, when present, is mostly of short hairs thinly scattered over the surface or limited to few hairs along the veins, midrib, and petiole.

Inflorescence.—The inflorescence is of the indeterminate class. It may be a spike, raceme, or a panicle; in some cases the spike may be secund. If paniculate, the axis is usually shortened so that the cluster of flowers appears more like a head than a panicle. Considerable variation may be observed in the nature of the inflorescence, such as a secund spike with a single flower at a node, two opposite axillary flowers at a node, flowers 2 or 3 in each axil, an open or a shortened panicle. While a particular form of inflorescence is characteristic for certain species, there is usually some variation, even on the same plant.

The bracts are usually sessile, more or less triangular, acute, with the same general sort of pubescence as that of the calyx and the pedicel. Bracteoles are smaller, but similar in form. Both bracts and bracteoles are usually caducous, but may persist until the flower is fairly mature.

Calyx.—The calyx furnishes the more important characters in specific delimitation. These characters are quite consistent and easily distinguished with a lens. One of the striking features is the type of pubescence; with the exception of *A. Gonzalezii*, which is essentially glabrous, the surface is covered either with pilose or glandular hairs, or even with sessile glands. There may be some hairs present with the glands, but one type or the other is dominant. The glandular hairs are usually stipitate, the stipe cells being hyaline and the secretory cell at the tip brown. In one or two species the glands are reduced, sessile, and merge into puberulence. In *A. quadrifidus* and *A. Wrightii*, the calyx is sessile or only very shortly pedicellate. The calyx-lobes range in size from shallow ones 1–2 mm. long, as in *A. Wrightii*, to the tentacular and subulate ones, 2 cm. long, as in *A. Thurberi*. All measurements were taken from calyces in fruit or full flower, as the calyx is accrescent.

Corolla.—When Nees segregated *Anisacanthus* from *Justicia* he described the corolla as having an entire posterior lip. However, earlier workers were correct in describing the lip as slightly emarginate; both types occur and variations may be found on the same plant. The corolla is tubular or funnel-shaped, more or less curved, with spreading, recurved, ligulate to elliptical lobes. The mature corolla is from 3½ cm. in length, with the lobes usually about as long as the tube. The total length, the length of the tube and lobes, and relative ampliation at the throat are of importance in specific delimitation. The corolla is usually bright red and thinly covered with short, pilose, red hairs. In only one species, *A. abditus*, is the corolla glabrous.

Stamens.—The stamens are inserted on the corolla-tube, alternate with the lobes and usually near the base of the central lobe of the 3-parted anterior lip. The filaments are highly colored and vary in length with the corolla-lobes, seeming to extend to the tips of the lobes. The anther-sacs of *Anisacanthus* are essentially parallel, equal, and inserted at the same height on the filament; these characters are key characters in generic delimitation. The filament is attached at the base of the connective which joins the sacs from about half to two-thirds of the length from the top.

Pistil.—The ovary is partly surrounded at the base by a disc. The style is filiform, as long as the corolla, and terminates in a slightly enlarged 2-lobed stigma. The characters of the ovary, style, and stigma are essentially the same for all species, and thus of little taxonomic importance.

Fruit.—The capsule is generally uniform throughout the genus, but in a few cases it presents characters of taxonomic value. It is typically a subglobose, 2-celled body and a relatively distinct stipe of more or less equal length. In *A. Gonzalezii* the body is not separated from the stipe by a noticeable constriction, but gradually tapers to the base. The seeds are 2 to 4 in number and are usually nearly parallel and opposite in the capsule. They vary only slightly within the genus, being

more or less discoid, tuberculate and shiny, and held upright at maturity by curved retinacula.

GENERIC RELATIONSHIPS

Anisacanthus is a member of the tribe Justiceae and the subtribe Eujusticieae which is usually placed near the end of the family. The tribe includes plants with a 2-lipped corolla, 2–4 stamens with 1–2-locular anthers. As regards other members of the tribe, the genus appears to be closest to *Carlowrightia*. However, *Anisacanthus* has a much larger calyx, corolla, and fruit; and the corolla is 2-lipped (3 plus 1 lobes), whereas in *Carlowrightia* it is about equally 4-parted. *Anisacanthus* is a much larger plant than *Carlowrightia* and, so far as known, contains no herbaceous species as does *Carlowrightia*. It appears to be fairly closely related to *Chileranthemum* and *Odontonema*, but is probably more advanced than these genera, since it lacks staminodia which they possess. Mucronate appendages at the base of the anther sacs are wanting in *Anisacanthus*; by this character alone it may be distinguished from *Justicia*. Also the anther-sacs are less equal and more oblique in *Justicia*. *Anisacanthus* also has been confused with *Beloperone*, but this genus has mucronate appendages on the anther-sacs and is more closely allied to *Justicia*. Moreover, *Anisacanthus* is quite closely related to *Jacobinia* with which it has been frequently confused. They both lack the appendages on the base of the anther-sacs, but the equal and parallel anther-sacs of *Anisacanthus* readily distinguish it from *Jacobinia*.

RELATIONSHIP OF THE SPECIES

While the author has not divided the genus *Anisacanthus* into subgenera or sections, there are certain groups of species which are more closely related to each other than to others.

From the calyx alone it is evident that *A. pumilus* shows closest relationship to *A. tulensis*, the main difference being in size (pl. 17, l and m). The relationship is also indicated by the

slender, ligulate-lobed corolla, and by the consistent number of 4 seeds in the capsules of both species.

Similarly, the calyx of *A. Thurberi* appears to be an exaggerated form of that of *A. insignis* (pl. 17, i and h). However, these two species are not as closely related as are *A. tulensis* and *A. pumila*. The size and proportions of the corolla parts differ, and the seed number is not consistent in *A. insignis*.

The type species, *A. quadrifidus*, seems closest to *A. Wrightii*. The calyx is quite similar, although differing in proportions (pl. 17, f, g, and j). As a matter of fact, the more deeply cleft calyx form in *A. Wrightii*, which is found generally in plants of the area between the two species, was first described as *A. junceus* and later placed in synonymy under *A. quadrifidus*. The size and form of the corolla and the characteristic secund spicate inflorescence give additional evidence of the relationship.

Although the calyx of *Anisacanthus abditus* somewhat resembles that of *A. quadrifidus* (pl. 17, k), several characters segregate it from all the other species. The large bracts, the nature and extent of the glandular pubescence, and the proportions of the corolla are all peculiar to this species. Also, the capsule is smaller than is usual in the genus.

Another distinct species is *A. Gonzalezii*, its cylindrical glabrous calyx-tube and ciliate calyx-lobes being different from those of every other species (pl. 17, n). The capsule characters are also unique in the genus (pl. 17, b), although the seed arrangement somewhat resembles that in *A. abditus*.

GEOGRAPHICAL DISTRIBUTION

The species of *Anisacanthus* are semi-xerophytic, usually growing on exposed, rocky slopes within a range confined almost entirely to Mexico. The center of distribution appears to be in southern Mexico, in the general region of Puebla, Oaxaca, Morelos, and the state of Mexico. Migration seems to have been mainly northward. Only three entities, *A. insignis* var. *linearis*, *A. Thurberi*, and *A. Wrightii*, extend into the United States. Representatives of the genus are found

throughout Mexico, however, and it may be anticipated that further collections will extend the present known ranges. The ranges of the species in the southern part of Mexico around the main center of distribution overlap somewhat, whereas the northern species are more distinct. There seems to be a small secondary center of distribution in the Sonoran region

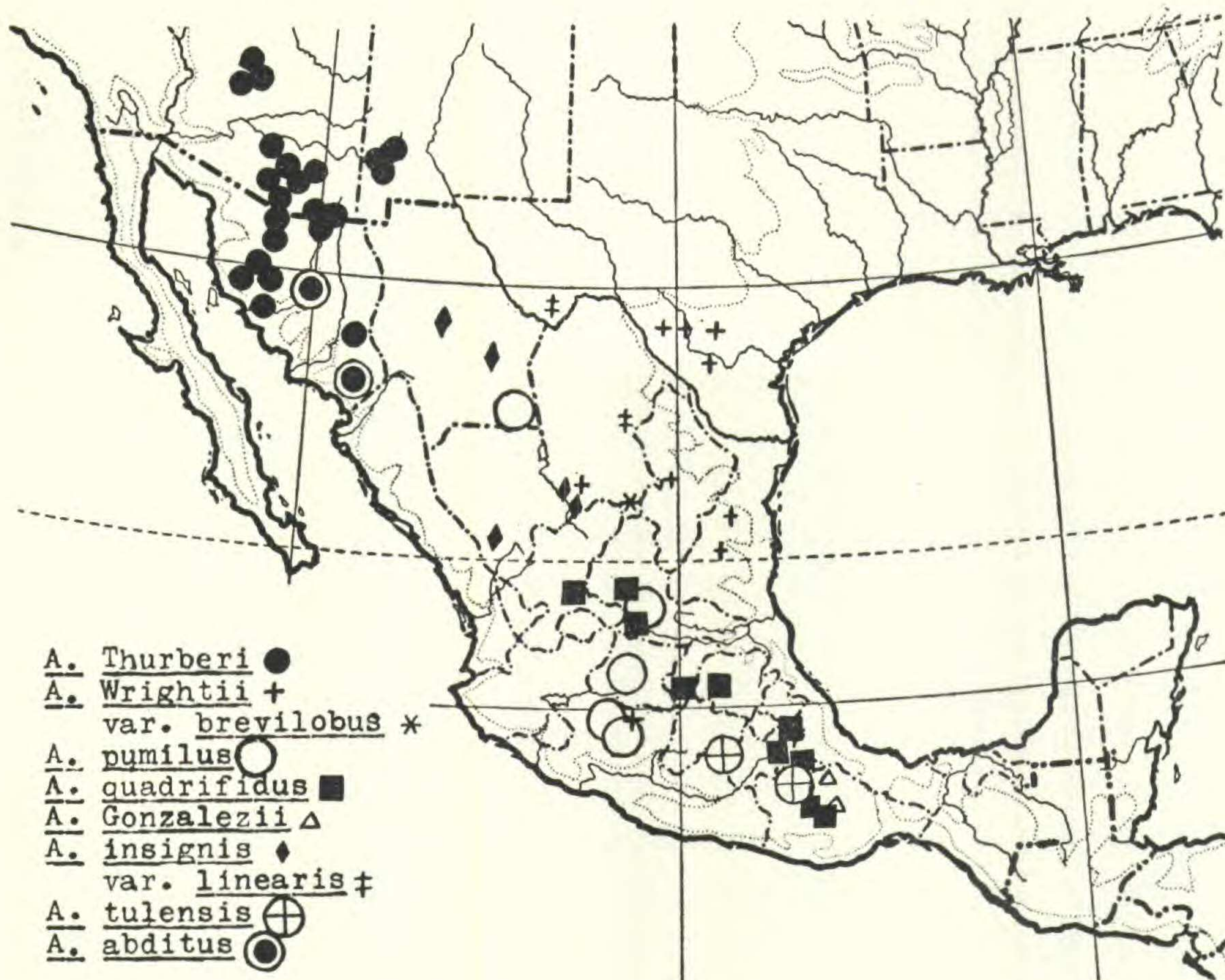


Fig. 1. The geographical distribution of the species of *Anisacanthus* in North America.

which shows a northerly migration with one species extending into Arizona and southwestern New Mexico. It is interesting to note the regions where *Anisacanthus* is absent; with the exception of the two Sonoran species one might say that it is not found on the coastal slopes or lowlands. In general, the plants of this genus are characteristic of the mountainous region of southern Mexico and the high central plateau extending northward (fig. 1).

ABBREVIATIONS

The herbaria from which material was obtained for study and from which specimens have been cited are indicated by the following abbreviations:

C = University of California, Berkeley.

F = Field Museum of Natural History, Chicago.

M = Missouri Botanical Garden, St. Louis.

NY = New York Botanical Garden.

TAXONOMY

Anisacanthus Nees in *Linnaea* 16: 307. 1842; in DC. *Prodr.* 11: 445. 1847; Bentham. & Hooker, *Gen. Pl.* 2: 1117. 1873; Gray, *Syn. Fl. N. Am.* 2¹: 326. 1878, and ed. 2, 2¹: 457. 1886; Engler & Prantl, *Die Natürl. Pflanzenf.* 4^{3b}: 327-328. 1895; Standley in *Contr. U. S. Nat. Herb.* [Trees and Shrubs of Mexico] 23: 1342-1343. 1926.

Branched shrubs, mostly about 1 m. high; stems terete, more or less minutely striate, younger branches usually pubescent in two opposite lines continuous with the base of the petioles, older stems covered with brown or gray bark exfoliating in thin strips; leaves opposite, petiolate or sessile, lanceolate to linear, punctate, cystoliths common on the upper surface; inflorescence spicate, racemose or paniculate, flowers borne singly or several at a node, secund or opposite; bracts and bracteoles mostly triangular to linear, usually caducous, agreeing with the calyx in pubescence; calyx subequally 5-lobed, lobes triangular to linear-acuminate, pubescent to glabrous; corolla usually red, mostly pilose, tubular to funnel-shaped, more or less arcuate, somewhat inflated at the base around the ovary, 2-lipped, usually recurved, the posterior lip entire or slightly emarginate, the anterior lip 3-lobed; stamens 2, epipetalous anteriorly, usually at the base of the central lobe and alternate with the corolla-lobes, filaments more or less thick and fleshy, colored, glabrous, anthers 2-celled, subequal, inserted at the same level or nearly so, parallel or slightly divergent at the base, connected to the middle or slightly below,

non-mucronate or appendaged; style filiform, glabrous, about as long as the corolla, stigma simple, 2-lobed; fruit a subpyriform capsule, slightly beaked, usually narrowed at the base to form a relatively distinct stipe, glabrous and shiny; seeds 2-4, discoid, more or less tuberculate, each supported by a curved retinaculum usually at about the same height in the body of the capsule.

Type species: **Anisacanthus quadrifidus** (Vahl) Nees in *Linnaea* **16**: 307. 1842.

KEY TO THE SPECIES

- A. Bracts of the inflorescence foliaceous, obscuring the calyx; entire surface of the plant glandular, at least in the younger stages.....1. *A. abditus*
- AA. Bracts of the inflorescence neither foliaceous nor obscuring the calyx; glands, when present, confined to the inflorescence.
 - B. Calyx glabrous or nearly so except for the hirsute-ciliate lobes, not glandular.....2. *A. Gonzalezii*
 - BB. Calyx distinctly glandular, the lobes not hirsute-ciliate.
 - C. Corolla 4-5 cm. long.
 - D. Leaves petiolate, linear-lanceolate to lanceolate, pilose to hispid.....3. *A. insignis*
 - DD. Leaves sessile, linear to linear-lanceolate, essentially glabrous.....3a. *A. insignis* var. *linearis*
 - CC. Corolla 3-4 cm. long.
 - D. Calyx 9-20 mm. long; stamens epipetalous below sinuses of anterior lip.....4. *A. Thurberi*
 - DD. Calyx 5-10 mm. long; stamens epipetalous at sinuses of anterior lip.
 - E. Calyx mostly 7-10 mm. long; lobes 5-6 mm. long, attenuate.....5. *A. quadrifidus*
 - EE. Calyx mostly 5 mm. long; lobes 1-3 mm. long, more or less acute, not alternate.
 - F. Calyx-tube equal to or shorter than the lobes.....6. *A. Wrightii*
 - FF. Calyx-tube much longer than the lobes.....6a. *A. Wrightii* var. *brevilobus*
 - BBB. Calyx pubescent, not glandular; the lobes not hirsute-ciliate.
 - C. Ultimate branches pubescent in lines; calyx 7-12 mm. long.....7. *A. pumilus*
 - CC. Ultimate branches evenly pubescent over entire surface; calyx 10-14 mm. long.....8. *A. tulensis*

1. **A. abditus** Brandg. in *Zoe* **3**: 348-349. 1893; Standl. in *Contr. U. S. Nat. Herb.* **23**: 1342. 1926.

Shrubs about 1-2 m. high, more or less glabrous-pubescent

throughout; leaves ovate to lanceolate, 1–6 cm. long, 0.5–3 cm. broad, petioles slender, 0.5–2.5 cm. long; bracts of the inflorescence quite distinct from the upper leaves, sessile, ovate to obspatulate, obtuse, about 1 cm. long, 4–5 mm. broad; inflorescence a terminal or lateral spike; calyx obscured by the subtending bracts, 5–7 mm. long, rather thin and delicate, deeply 5-cleft, lobes lance-attenuate; corolla 3–4 cm. long, glabrous, tubular, the 4 lobes subequal, shorter than the tube, 5 mm. broad, ovate; filaments alternate, attached near the base of the central anterior lobe, 7–9 mm. long, anthers 3 mm. long, sacs connected to below the middle; ovary extending about 1 mm. above the disc; capsule 1 cm. long, about 3 mm. in diameter, the body more or less oblong, slightly longer than the stipe; seeds 4, 2–3 mm. in diameter, tuberculate, one pair borne obliquely about 2 mm. above the other.

DISTRIBUTION: mountainous region of central Sonora, Mexico.

MEXICO: SONORA: Las Durasuillas, May 14, 1892, *Brandege* s.n. (C TYPE, F); vicinity of Alamos, March, 1910, *Rose, Standley & Russell* s.n. (F); Caramечи, Rio Mayo, Dec. 3–10, 1934, *Gentry 1178* (F, NY, M).

2. A. Gonzalezii Greenm. in Proc. Am. Acad. **39**: 89. 1903; Standl. in Contr. U. S. Nat. Herb. **23**: 1342. 1926.

Suffruticose; stems uniformly pubescent; leaves ovate-lanceolate to linear-lanceolate, 1.5–4 cm. long, 4–17 mm. broad, puberulent or often slightly pubescent above, pilose below, petioles 1–5 mm. long, pubescent; inflorescence spicate, flowers 1–2 in each axil, sessile; bracts linear to linear-lanceolate, 0.5–2 cm. long, 1–3 mm. broad, finely pubescent, ciliate; calyx 5–11 mm. long, tube cylindrical, glabrous, lobes lance-attenuate, hirsute-ciliate, about as long as the tube; corolla 3.5–4 cm. long, slightly infundibuliform, posterior lip emarginate, lobes about one-third total length of the corolla, ligulate, slightly recurved; stamens attached near the base of the anterior lip and alternate with the lobes, filaments 11–13 mm. long, anther-sacs 4 mm. long, parallel, connected to below the middle; ovary extending about 1.5 mm. above the disc; capsule 16–19 mm. long, 3–4 mm. in diameter, gradually tapering to the base; seeds 4, 3–4 mm. in diameter, one pair borne obliquely above the other.

DISTRIBUTION: central and northern Oaxaca, Mexico.

MEXICO: OAXACA: Las Naranjas, Aug., 1908, *Purpus* 3018 (C), and 3041 (F, M, NY).

3. *A. insignis* Gray, Syn. Fl. N. Am. ed. 2, 2¹: 457. 1886; Standl. in Contr. U. S. Nat. Herb. 23: 1343. 1926.

Pl. 18, fig. A.

Drejera puberula Torr. in U. S. & Mex. Bound. Surv. Bot. 123. 1859, in part.

Anisacanthus pumilus Wats. in Proc. Am. Acad. 18: 133. 1883, in part, not Nees in DC. Prodr. 11: 445. 1847.

Slender, vine-like shrub, 1.5–2.5 m. high; stems pubescent in lines; lower leaves lanceolate to ovate, 2.5–7 cm. long, 1–3 cm. broad, slightly acuminate, puberulent, pilose to tomentose, petioles 3–20 mm. long, tomentose; flowers borne in short racemose clusters in the axils of fallen leaves; bracts and bracteoles puberulent, sometimes glandular, obovate, elliptic or ovate, reduced from about 10 mm. to about 2 mm. in length; pedicels 3–8 mm. long, glandular; calyx 6–10 mm. long, stipitate-glandular, lobes separate almost to the base, linear-ligulate, somewhat attenuate; corolla mostly 5 cm. long, curved, slightly infundibuliform, lobes linear, recurved, longer than the tube; stamens alternate, inserted at the base of the central anterior lobe, anthers 4 mm. long, anther-sacs parallel, slightly oblique; disc at base of ovary about 1 mm. high; capsule 2 cm. long, stipe as long as or longer than the body; seeds 4, sometimes 1 or 2 aborted, about 5 mm. in diameter, slightly obliquely discoid, brown, more or less tuberculate.

DISTRIBUTION: central Mexican plateau region from Durango to Coahuila and Chihuahua.

MEXICO: CHIHUAHUA: gravelly banks along the Cibolo of the Rio Grande, May–June, *Bigelow s.n.* (NY); valley of the Rio Conchos below Santa Rosalia, April 21, 1847, *Gregg* 504 (M, NY); vicinity of Chihuahua, alt. 1300 m., April 8–27, 1908, *Palmer* 51 (F, M, NY); rocky hills near Chihuahua, March 23 & April 17, 1885, *Pringle* 268 (F, M, NY); Bachimba Canyon, April 2, 1886, *Pringle* 862 (C, F, M, NY); Santa Rosalia, south of Chihuahua, April 30, 1847, *Wislizenus* 267 (M). COAHUILA: Valley of Parras, April 11, 1847, *Gregg* 407 (M); Parras, June 8–28, 1880, *Palmer* 1017 (F, NY), and Oct. 6–11, 1898, 430 (C, F, M, NY); Parras, Feb.–March, 1905, *Purpus* 1046 (C, F, M, NY); Sierra de Parras, Oct., 1910, *Purpus* 4752 (C, F, M). DURANGO: City of Durango and vicinity, April–Nov., 1896, *Palmer* 25 (C, F, M, NY); Pueblita, April 11, 1900, *Trelease* 75 (M).

3a. *A. insignis* Gray var. *linearis* Hagen, var. nov.⁷

Pl. 18, fig. B.

Lower leaves and those of the flowering branches sessile, linear to linear-lanceolate, 1–4 cm. long, 1–5 mm. broad, essentially glabrous.

DISTRIBUTION: southwestern Texas and northern Mexico.

TEXAS: CHISOS MOUNTAINS, BREWSTER CO.: lower end of Juniper Canyon, alt. 1158–1219 m., July 15–18, 1921, *Ferris & Duncan 2990* (M, NY); dry creek bed, lower Blue Creek Canyon, alt. 1370 m., June 23, 1931, *Moore & Steyermark 3202* (C, M TYPE, NY); Aug. 2, 1931, *Mueller 8166* (F, M); rocky cliffs and ledges, Oak Canyon, May 24, 1928, *Palmer 34148* (M, NY).

MEXICO: COAHUILA: near the northern entrance of El Puerto de San Lazaro, June 16, 1936, *Wynd & Mueller 106* (M).

4. *A. Thurberi* (Torr.) Gray, Syn. Fl. N. Am. 2¹: 328. 1878, and ed. 2, 2¹: 457. 1886; Hemsl. Biol. Centr.-Am. Bot. 2: 522. 1882; Woot. & Standl. in Contr. U. S. Nat. Herb. 19: 597. 1915; Standl. in Contr. U. S. Nat. Herb. 23: 1342. 1926.

Drejera Thurberi Torr. in U. S. & Mex. Bound. Surv. Bot. 124. 1859.

Drejera puberula Torr. *Ibid.* 123.

Low shrub, 0.5–1.5 m. high; stem pubescence reduced to a few scattered hairs in two opposite lines; leaves lanceolate, mostly 3–5 cm. long, 7–15 mm. broad, hispid to glabrate, petioles 1–5 mm. long; flowers borne singly in the axils of the bract-like upper leaves, or in 2–5-flowered greatly foreshortened axillary racemose clusters; bracts and bracteoles lanceolate to linear, acute, mostly 2–10 mm. long, 1–3 mm. broad, puberulent, often slightly pilose along the midrib and margin; pedicels 3–7 mm. long, glandular; calyx .9–2 cm. long, deeply 5-cleft, stipitate-glandular, puberulent, with few pilose hairs scattered throughout, lobes linear-attenuate, more or less tentacular; corolla dull red, 3.5–4 cm. long, tube funnel-form, lobes shorter than the tube, ovate, obtuse, divergent but scarcely recurved, upper lip slightly emarginate; stamens

⁷ *Anisacanthus insignis* Gray var. *linearis*, var. nov., *A. insigni* similis, sed foliis inferioribus sessilibus linearibus vel lineari-lanceolatis, 1–4 cm. longis, 1–5 mm. latis, glabris differt.

epipetalous, inserted below the sinuses of the anterior lip, filaments about 2 cm. long, anther-sacs 3–4 mm. long, equal, parallel, connected to below the middle; capsule about 15–18 mm. long, about 6 mm. in diameter, stipe shorter than the subvoid body; seeds 2, slightly tuberculate, about 5 mm. in diameter.

DISTRIBUTION: from southern Sonora in Mexico northward along the western mountainous slopes into central Arizona, and eastward into the southwestern part of New Mexico.

UNITED STATES: ARIZONA: near creek, Rhoda Riggs' Ranch, Chiricahua Mts., alt. 1676 m., Oct. 22, 1906, *Blumer 1304* (F, M, NY); Box Canyon, Chiricahua Mts., alt. 1676 m., July 9, 1907, *Blumer 1248* (F, M, NY); Nogales, May, 1892, *Brandegee s.n.* (C); Fort Whipple, on gravelly hillsides, May 3, 1865, *Coues & Palmer 190-c* (M); 40 miles south of Fort Whipple, Aug. 5, 1865, *Coues & Palmer 130* (M); 5 miles west of Tucson, in Tucson Mts., March 7, 1934, *Detwiler 47* (F); Douglas, rocky draws and washes, May, 1907, *Goodding 2232* (C, M); dry, rocky hillsides 5 miles northeast of Rodeo, June 16, 1930, *Goodman & Hitchcock 1153* (C, F, M, NY); Rincon Pass, Oct. 19, 1900, *Griffiths 2018* (NY); Sabenio Cañon, March 30, 1901, *Griffiths 2595* (NY); Santa Ritas, foot of Old Baldy, April, 1901, *Griffiths 2652* (NY); Roadside Mine, Pima County, April 21, 1932, *Harrison & Kearney 8528* (F); hills along the Rio San Pedro, Sept. 9, 1858, *Hayes 598* (NY); Congress Junction, alt. 91 m., May 4, 1903, *Jones s.n.* (M); Cave Creek Canyon, Chiricahua Mts., 1829–2438 m., June 26–29, 1927, *Kusche s.n.* (F); Santa Catalina Mts., April, 1881, *Lemmon s.n.* (C); south of Bisbee, Mexican boundary line, Oct. 3, 1892, *Mearns 1024* (C, M, NY); Patagonia, May 6, 1902, *Orcutt s.n.* (C); 1869, *Palmer s.n.* (NY); Tucson, April, 1884, *Parish s.n.* (M), and May 25, 1884, *195* (F); Sierra Tucson, April 25, 1884, *Parish s.n.* (NY); Tucson, April, 1884, *Parish & Parish s.n.* (C); Picacho Mts., March 23, 1930, *Peebles 6473* (NY); Santa Catalina Mts., April 18, 1881, *Pringle s.n.* (F), and June, 1882, *s.n.* (M, NY); Sierra Tucson, April 25, 1884, *Pringle s.n.* (F), and June 1, 1884, *4832* (F, NY); Tucson, in arroyo, April 15, 1901, *Shear 4231* (NY); Tucson, date lacking, *Spring s.n.* (C); west of Sonoita, alt. 1433 m., April 18, 1934, *Stone 39* (NY); Stone Cabin Canyon, Santa Rita Mts., alt. 1524 m., May 23, 1903, *Thornber 294* (C, M); foothills of Tucson Mts., alt. 762 m., May 9, 1903, *Thornber 474* (C); Ft. Huachuca, May, 1892, *Wilcox s.n.* (NY), and 1894 (M).

NEW MEXICO: along the Gila River and mesa between cliff and upper canyon of Gila, Grant Co., alt. 1300–1350 m., July 25, 1920, *Eggleston 16794* (M); Mangas Canyon, May and June, 1880, *Greene s.n.* (NY), June 1, and July 3, 1880, *s.n.* (F), and June and July, 1880, *12502* (M); Dog Spring, Grant Co., May 26, 1892, *Mearns 113* (NY); Mangas Springs, 18 miles northwest of Silver City, alt. 1453 m., June 9, 1903, *Metcalf 113* (C, M, NY); on the upper Rio Grande, below El Paso, 1851–1852, *Wright 1456* (M, NY).

MEXICO: SONORA: San Miguel de Horcasitas, May, 1892, *Eisen s.n.* (C); San Bernardo, Rio Mayo, Feb. 16, 1935, *Gentry 1309* (F, M, NY); El Alamo, Magdalena, May 25, 1925, *Kennedy 7107* (C); Torres, Jan.–March, 1902, *Purpus 409* (C, M).

5. **A. quadrifidus** (Vahl) Nees in *Linnaea* **16**: 307. 1842; Standl. in *Contr. U. S. Nat. Herb.* **23**: 1343. 1926.

Justicia coccinea Cav. *Ic. Pl.* **2**: 77, *pl.* 199. 1793, not Aublet.

Justicia quadrifida Vahl, *Enum. Pl.* **1**: 124. 1805.

Justicia virgularis Salisb. *Parad. Lond.* *pl.* 50. 1806.

(?) *Justicia superba* Hort. ex Nees in *DC. Prodr.* **11**: 445. 1847.

Anisacanthus virgularis (Salisb.) Nees in *DC. Prodr.* **11**: 445. 1847; Hemsl. *Biol. Centr.-Am. Bot.* **2**: 522. 1882; Gray, *Syn. Fl. N. Am.*, ed. 2, **2**¹: 457. 1886.

Younger branches green, somewhat purplish, pubescent in two opposite lines; leaves short-petiolate to sessile, linear to lanceolate, long-acuminate, 2–5 cm. long, 3–13 mm. broad, glabrous except for minute pubescence at base and along midrib above, punctate, the upper leaves much reduced; inflorescence spicate, secund, flowers sessile to short-pedicillate, almost always solitary, rarely 2 in the axils of the upper bracts; bracts and bracteoles lanceolate, glandular, ciliate, 3–4 mm. long, caducous; calyx glandular, 6–10 mm. long, deeply 5-cleft, lobes ciliate, lance-acuminate, 5–6 mm. long at anthesis; corolla scarlet, 3.5–4 cm. long, slightly curved, scarcely dilated at the throat, lobes recurved, ligulate, about as long as the tube; stamens inserted at the sinuses of the anterior lip, anthers 3–4 mm. long, anther-sacs equal or nearly so, parallel; capsule 15–18 mm. long, stipe as long as the body; seeds 4, subdiscoid, about 5 mm. in diameter, more or less tuberculate.

DISTRIBUTION: central Oaxaca, Mexico, northward into Puebla, Hidalgo and Queretaro, and westward into San Luis Potosi and Zacatecas.

MEXICO: HIDALGO: Ixmiquilpan, July, 1905, *Rose, Painter & Rose 8944* (F, M, NY); OAXACA: Vallè de Oaxaca, alt. 1600 m., Nov. 8, 1906, *Conzatti 1519* (F); Las Naranjas, Aug., 1908, *Purpus 3018* (F, M, NY); Oaxaca Valley, alt. 1524 m., Nov. 7, 1894, *Smith 731* (M, NY); PUEBLA: vicinity of Puebla, Acatzinco, District of Tepeaca, alt. 2110 m., July, 1907, *Arsène & Amable 3567* (M, NY), and Aug., 1907, *1568* (M); Tehuacan, Dec., 1892, *Liebmann 10600* (F); Acatzinco, Nov., 1909, *Nicolas 35* (F); valley near Tehuacan, alt. 1524 m., Aug. 5, 1901, *Pringle 9390* (F, M); Tehuacan, Sept., 1911, *Purpus 5669* (C); near El Riego, Tehuacan, Sept., 1905, *Rose, Painter & Rose 10033* (F, M); QUERETARO: near San Juan del Rio, Aug. 17, 1905, *Rose, Painter & Rose 9515* (NY); same locality, Nov., 1827, *Berlandier 1237* (NY); SAN LUIS POTOSI: Dec. 27, 1848, *Gregg 578* (M); 1878, *Parry & Palmer 706* (F); gravel washes, Bocas, Aug. 17, 1891, *Pringle 3820* (C,

F, NY); region of San Luis Potosi, 1879, *Schaffner 367* (F, NY); ZACATECAS: city of Zacatecas, 1908, *Lloyd 10* (F).

Besides the above, several authentic collections from European gardens have been examined. Although data accompanying them are usually quite incomplete, they have been of importance in establishing the identity of this species.

6. *A. Wrightii* (Torr.) Gray, *Syn. Fl. N. Am.* **2**¹: 238. 1878, and ed. 2, **2**¹: 457. 1886; *Hemsl. Biol. Centr.-Am. Bot.* **2**: 522. 1882; *Standl. in Contr. U. S. Nat. Herb.* **23**: 1343. 1926.

Drejera Wrightii Torr. in *U. S. & Mex. Bound. Surv. Bot.* **123**. 1859.

Drejera juncea Torr. *Ibid.* **124**.

Anisacanthus junceus (Torr.) *Hemsl. Biol. Centr.-Am. Bot.* **2**: 522. 1882.

Young branches dull green, pubescent in two lines; lower leaves broadly lanceolate, 1–5 cm. long, 0.5–2 cm. broad, hispid to glabrate, petioles 3–10 mm. long, pilose; flowers usually borne singly or in pairs in secund, terminal, spicate inflorescences, subsessile to short-pedicellate; bracts and bracteoles lanceolate-acuminate, 2–5 mm. long, puberulent; calyx about 0.5 cm. long, puberulent, glandular, lobes ovate to lanceolate, 2–3 mm. long, acute, few, scattered hairs along margin and at tip; corolla 3–4 cm. long, lobes narrowly ovate, obtuse, posterior lobe slightly emarginate, tube slender, nearly straight, scarcely dilated at the throat, longer than the lobes; stamens epipetalous, inserted near the sinuses of the central anterior lobe, filament about 1 cm. long, anthers 3 mm. long, anther-sacs connected nearly half their length from the tips; ovary extending about 2 mm. above the disc; capsule about 15 mm. long, body about 6 mm. thick, shorter than the stipe; seeds 2, rarely 4, about 5 mm. in diameter.

DISTRIBUTION: mostly along the eastern part of the central plateau region of Mexico, in the states of Tamaulipas, Nuevo Leon, and Coahuila. It has been found at one station in northern Michoacan, and from several localities in Bexar, Uvalde, and Kinney counties in Texas.

UNITED STATES: TEXAS: Fort Clark, June–July, 1857, *Blake s.n.* (NY); San Antonio, Bexar Co., tropical life zone, June 27, 1911, *Clemens & Clemens s.n.* (F, M); Concan, Uvalde Co., along rocky creeks, June 15, 1916, *Palmer 10212*

(M); valley of the Rio Grande below Donana, *Parry, Bigelow, Wright & Schott s.n.* (NY); rocky banks along the Rio Frio, June, 1884, *Reverchon 1580* (F, M, NY); same locality, *Schott s.n.* (F), and Oct. 19, 1851, *733* (NY); Uvalde Co., growing along railroad, June 30, 1929, *Schultz 3057* (F); May–Oct., 1849, *Wright 435* (M, NY TYPE).

MEXICO: COAHUILA: La Pena, Nov., 1852, *Thurber 849* (NY TYPE of *Drejera juncea* Torr.); MICHOACAN: Morelia, Dos Tetecos, March 7, 1911, *Arsène 36* (F); NUEVO LEON: Monterrey, Guadalupe, alt. 540 m., June, 1911, *Arsène & Abbot 6228* (M); Monterrey, damp rich soil in thickets, *Edwards & Eaton s.n.* (NY); by streams, El Carrizo, alt. 427 m., June 16, 1906, *Lozano 10256* (C, F, M, NY); arroyos of mesas near Monterrey, July 23, 1888, *Pringle 1891* (C, F, NY); valley of Monterrey, June 17, 1889, *Pringle 2710* (C, F, M), and Aug. 19, 1903, *11663* (F); TAMAULIPAS: La Vegonia, vicinity of San Jose, alt. 823 m., July 20, 1930, *Bartlett 10526* (F); La Tamaulipeca, vicinity of San Miguel, July 27, 1930, *Bartlett 10670* (F); vicinity of Victoria, alt. 320 m., Feb. 1–April 9, 1907, *Palmer 120* (C, F, M, NY).

The specimens of Lozano and Bartlett are atypical, having calyces very nearly like those of *A. quadrifidus*. Thurber's specimen, which Torrey called *Drejera juncea*, is somewhat like the two above, but judging mainly by the glandular characters, general size of the calyx and of the anthers, its relationship is evidently with *A. Wrightii* rather than *A. quadrifidus*.

6a. *A. Wrightii* (Torr.) Gray var. *brevilobus* Hagen, var. nov.⁸

Lower leaves subsessile, lanceolate to linear-lanceolate, 1.5–4 cm. long, 3–8 mm. broad, glabrate; calyx 4–5 mm. long, the tube several times longer than the triangular, acute lobes.

DISTRIBUTION: northern Mexico, known only from the type locality.

MEXICO: COAHUILA: Chojo Grande, 27 miles southeast of Saltillo, July 16, 1905, *Palmer 719* (C, F, M TYPE, NY).

This variety is quite distinct on account of the short, triangular, acute calyx-lobes, and the narrower, subsessile leaves.

7. *A. pumilus* (Dietr.) Nees in DC. Prodr. 11: 445. 1847; Gray, Syn. Fl. N. Am., ed. 2, 2¹: 457. 1886; Hemsl. Biol. Centr.-Am. Bot. 2: 522. 1882; Standl. in Contr. U. S. Nat. Herb. 23: 1342. 1926.

⁸ *Anisacanthus Wrightii* (Torr.) Gray var. *brevilobus*, var. nov., foliis inferioribus subsessilibus lanceolatis vel lineari-lanceolatis, 1.5–4 cm. longis, 3–8 mm. latis, glabris; petiolis 1–2 mm. longis; calyce 4–5 mm. longo, lobis tubo brevioribus, triangularibus, acutis.

Justicia pumila Dietr. in Vollst. Lex. Gärtn. Nachtr. 4: 197. 1818.

Drejera Greggii Torr. in U. S. & Mex. Bound. Surv. Bot. 124. 1859.

Anisacanthus Greggii (Torr.) Gray, Syn. Fl. N. Am. 2¹: 328. 1878.

Shrub, 2.5–3 m. high; stem dark brown, pubescent in two opposite decussating lines; leaves ovate-lanceolate to linear-lanceolate, 2–3 cm. long, 3–10 mm. broad, hispid, subsessile to short-petiolate; flowers in compact racemose clusters of from one to several borne in the axils of fallen leaves; bracts and bracteoles about 2 mm. long, puberulent, ciliate, acute; calyx short-pedicellate, about 7–12 mm. long, puberulent, pilose, deeply and subequally 5-lobed, the lobes about 6–9 mm. long, acute; corolla 4–5 cm. long, bright red, thinly pilose, slender, curved, slightly dilated at the throat, the linear-ligulate lobes longer than the tube, recurved; stamens inserted near the base of the central lobe of the anterior lip, anther-sacs 4 mm. long, nearly equal, parallel, connected about half way to the base; capsule about 2 cm. long, body 5–6 mm. thick, as long as the stipe; seeds 4, about 5 mm. in diameter, slightly tuberculate.

DISTRIBUTION: northern Michoacan to San Luis Potosi, and northwestward along the plateau region to southern Chihuahua.

MEXICO: Gonzales Junction, April, 1910, *Rusby s.n.* (NY); MICHOACAN: vicinity of Morelia, Quinceo, alt. 1900 m., March 11, May 25, 1909, *Arsène 2778* (M), and July 18, 1909, *s.n.* (NY); hills east of Zipimeo, May 11, 1849, *Gregg 810* (M); GUANAJUATO: Silao, July, 1903, *Purpus 140* (C); SAN LUIS POTOSI: in the region of San Luis Potosi, 22° N. Lat., alt. 1829–2434 m., 1878, *Parry & Palmer 706½* (M); CHIHUAHUA: battleground of Paso del Gallinero, near Dolores, Dec. 29, 1848, *Gregg 587* (NY TYPE of *Drejera Greggii* Torr., M).

8. *A. tulensis* Greenm. in Field Mus. Publ. Bot. Ser. 2: 343. 1912.

Justicia superba Sessè & Moçiño, Pl. Nov. Hisp., ed. 2, p. 3. 1893, in part; not *J. superba* Hort. ex Nees in DC. Prodr. 11: 445. 1847, in synonymy.

Ultimate branches tomentose to pilose over entire surface; leaves lanceolate to linear-lanceolate, 1.5–5 cm. long, 4–20 mm. broad, puberulent above, sparsely pubescent below, mostly

along the veins and margins, petioles 1–7 mm. long, tomentose to pilose; inflorescence mostly secund, racemose, usually not more than 2 flowers maturing in a cluster; bracts linear-lanceolate, 5–10 mm. long, puberulent, ciliate, bracteoles similar but smaller, both bracts and bracteoles caducous; pedicels 1–5 mm. long, tomentose to pilose, puberulent; calyx puberulent, tomentose to sparsely pilose, 10–14 mm. long, lobes lanceolate, as long as the tube or slightly longer; corolla 5–5.5 cm. long, finely pilose, tube slender, arcuate, about 2 cm. long, lobes linear-ligulate, recurved, distinctly longer than the tube, posterior lip slightly emarginate; stamens alternate, inserted near the base of the central lobe of the anterior lip, filaments 18–25 mm. long, anthers 4 mm. long, anther-sacs subequal, slightly oblique, connected almost half their length from the tip; capsule 17–25 mm. long, about 5–8 mm. thick, stipe longer than the body; seeds 4, subdiscoid, 5–6 mm. in diameter, tuberculate.

DISTRIBUTION: southern Mexico.

MEXICO: OAXACA: Santa Maria del Tule, alt. 1600 m., March 31, 1907, *Conzatti 1773* (F TYPE); MORELOS: Ayacapixtla, 1787–1795–1804, *Sessè & Moçiño 293* in part, and *373* (F).

EXCLUDED SPECIES

Anisacanthus glaberrimus Jones in *Contr. West. Bot. No. 15: 151. 1929* = (?) **Odontonema**.

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| Arsène, G. & Bro. Abbot. <i>6228</i> (6). | Edwards, Dr., & Maj. Eaton. — (6). |
| Arsène, G. & Bro. Amable. <i>1568, 3567</i> (5). | Eggleston, W. W. <i>16794</i> (4). |
| Bartlett, H. H. <i>10526, 10670</i> (6). | Eisen, G. — (4). |
| Berlandier, J. <i>1237</i> (5). | Ferris, Roxana S. & C. D. Duncan. <i>2990</i> (3a). |
| Bigelow, J. M. — (3). | Gentry, Howard Scott. <i>1178</i> (1), <i>1309</i> (4). |
| Blake, S. F. — (6). | Goodding, Leslie N. <i>2232</i> (4). |
| Blumer, J. C. <i>1248, 1304</i> (4). | Goodman, George J. & C. Leo Hitchcock. <i>1153</i> (4). |
| Brandege, T. S. — (1), — (4). | Greene, Edward Lee. —, —, <i>12502</i> (4). |
| Clemens, Mr. & Mrs. Joseph. <i>1065</i> (6). | Gregg, J. <i>407, 504</i> (3), <i>578</i> (5), <i>587, 810</i> (7). |
| Conzatti, C. <i>1519</i> (5), <i>1773</i> (8). | |
| Coues, Elliott & Edward Palmer. <i>130, 190-c</i> (4). | |

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 Hayes, Sutton. 598 (4).
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 Rusby, H. H. — (7).
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 Schultz, Ellen D. 3057 (6).
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Previously published and accepted names are indicated by ordinary type; new names by bold face type; and synonyms by *italics*.

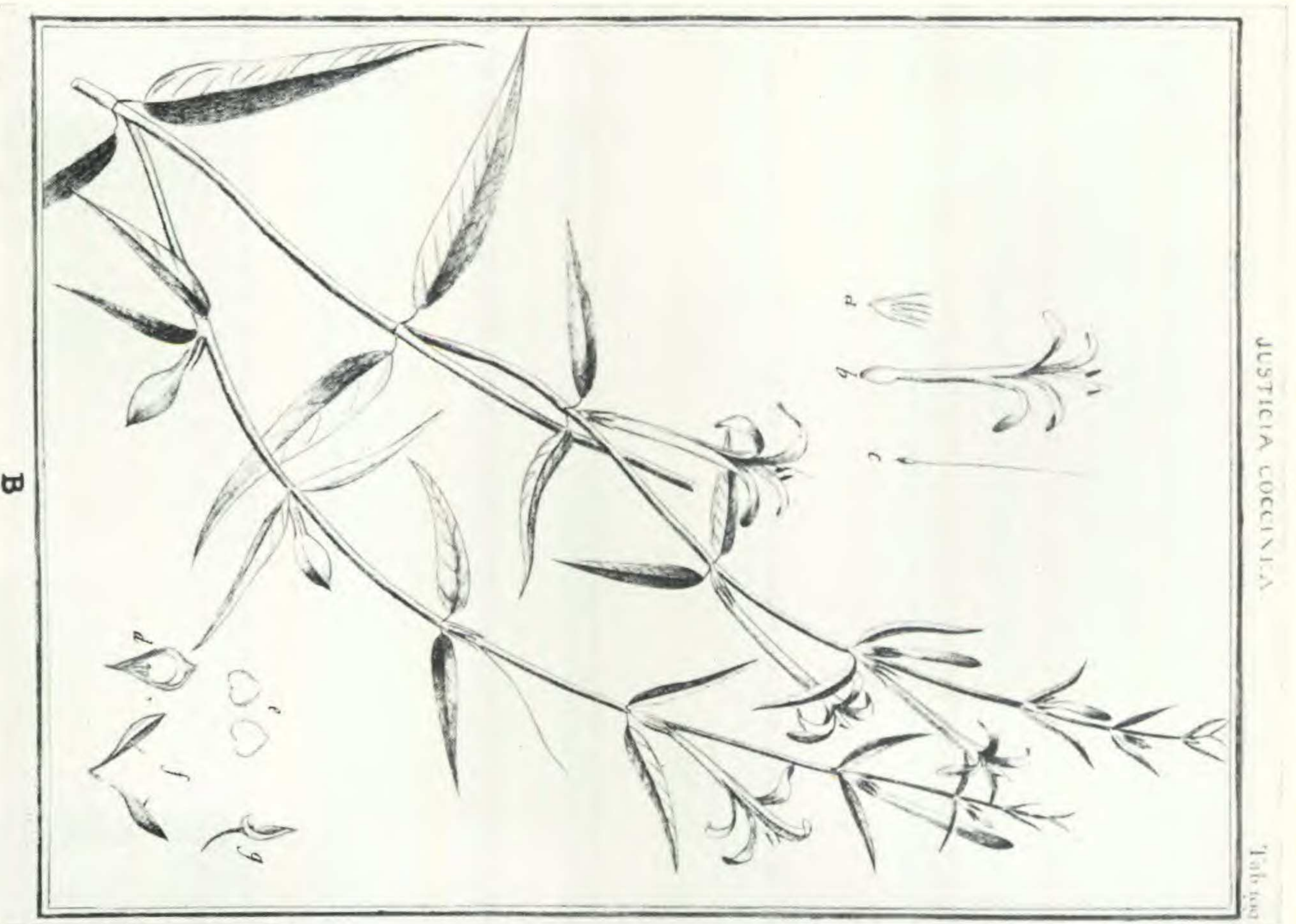
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EXPLANATION OF PLATE

PLATE 16

- A. From Salisbury, 'Paradisus Londinensis,' *pl.* 50. 1806, illustrating *Justicia virgularis* Salisb., which equals *Anisacanthus quadrifidus* (Vahl) Nees.
- B. From Cavanilles, 'Icones et Descriptiones Plantarum,' *pl.* 199. 1793, illustrating *Justicia coccinea* Cav., which equals *Anisacanthus quadrifidus* (Vahl) Nees, the type species of the genus.

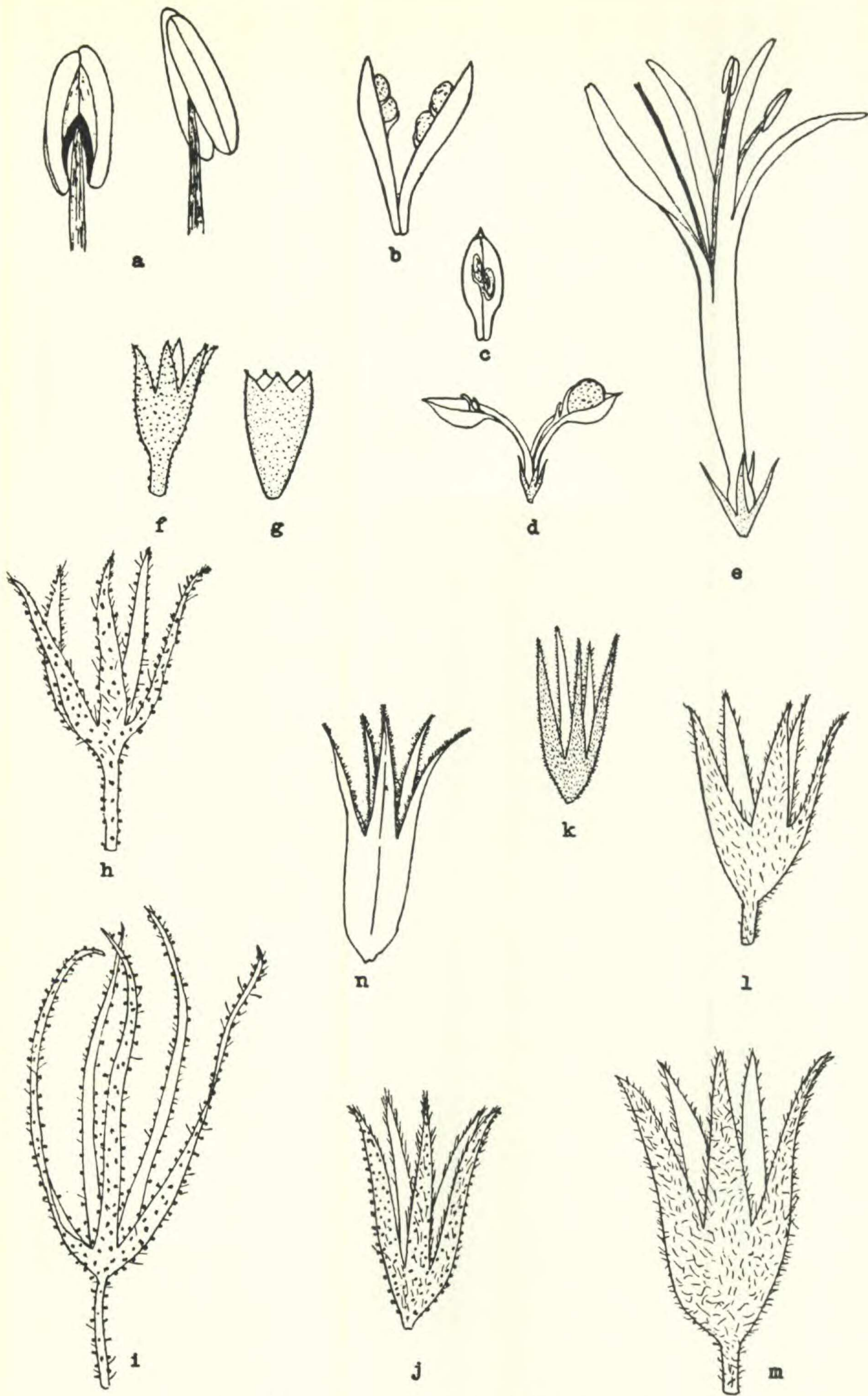


HAGEN—THE GENUS ANISACANTHUS

EXPLANATION OF PLATE

PLATE 17

- a. Anther of *Anisacanthus quadrifidus* $\times 5$.
- b. Dehisced capsule of *Anisacanthus Gonzalezii* showing position of seeds, $\times 1.4$.
- c. Single valve of the capsule of *Anisacanthus abditus* inner-face view, $\times 1.4$.
- d. Dehisced capsule of *Anisacanthus quadrifidus* with one seed in place, $\times 1.4$.
- e. Single flower of *Anisacanthus quadrifidus*, $\times 2.1$.
- f. Calyx of *Anisacanthus Wrightii* $\times 3.5$.
- g. Calyx of *Anisacanthus Wrightii* var. *brevilobus* $\times 3.5$.
- h. Calyx of *Anisacanthus insignis* $\times 3.5$.
- i. Calyx of *Anisacanthus Thurberi* $\times 3.5$.
- j. Calyx of *Anisacanthus quadrifidus* $\times 3.5$.
- k. Calyx of *Anisacanthus abditus* $\times 3.5$.
- l. Calyx of *Anisacanthus pumilus* $\times 3.5$.
- m. Calyx of *Anisacanthus tulensis* $\times 3.5$.
- n. Calyx of *Anisacanthus Gonzalezii* $\times 3.5$.



HAGEN—THE GENUS ANISACANTHUS

EXPLANATION OF PLATE

PLATE 18

- A. *Anisacanthus insignis* Gray. From a typical specimen, *Palmer 430*, in the Missouri Botanical Garden Herbarium.
- B. *Anisacanthus insignis* Gray var. *linearis* Hagen. From the type collection, *Moore & Steyermark 3202*, in the Missouri Botanical Garden Herbarium.